

Claims: Cancel all claims of record (claims 1 – 19) and substitute new claims 20 to 38 as follows.

20. A device for the volumetric measurement and dispensing of liquids comprising:

- a. a variable volume chamber,
- b. a means for controllably adjusting the volume of said variable volume chamber,
- c. a plurality of valves,
- d. at least one conduit disposed between said variable volume chamber and at least one of said plurality of valves,
- e. a means to detect the presence or absence of liquid in said at least one conduit so that the precise location of said liquid in relation to said plurality of valves and said variable volume chamber may be determined, and
- f. a means for removing gas from a system formed by said variable volume chamber, said plurality of valves, and said at least one conduit,

whereby said liquid aspirated into said system substantially fills said system thereby minimizing the difference between the volume of the aspirated liquid and the volume of said system.

21. The device of claim 20, wherein said device further comprises a controller,

whereby said controller is in communication with said means to detect the presence or absence of said liquid in said at least one conduit, said means for controllably adjusting the volume of said variable volume chamber, and a means for actuating said plurality of valves.

22. The device of claim 20, wherein at least one of said plurality of valves is in fluid communication with both said variable volume chamber and a body of gas disposed external to the volume defined by the interior of said system,

whereby said gas may be controllably expelled into said body of gas from said system or a volume of gas may be aspirated into said system from said body of gas.

23. The device of claim 22, wherein said at least one of said plurality of valves is in fluid communication with both said variable volume chamber and a body of liquid,

whereby said liquid may be controllably aspirated into said variable volume chamber from said body of liquid or expelled from said variable volume chamber into said body of liquid.

24. The device of claim 20, wherein said means for removing gas from said system formed by said variable volume chamber, said plurality of valves, and said at least one conduit further comprises a means to minimize the free volume of said system prior to aspiration of said liquid.

25. The device of claim 20, wherein said means for removing gas from said system formed by said variable volume chamber, said plurality of valves, and said at least one conduit further comprises a means to substitute said liquid for said gas within said system by controllably adjusting the volume of said variable volume chamber in conjunction with the actuation of said at least one of said plurality of valves.

26. The device of claim 20, wherein said means for removing gas from said system formed by said variable volume chamber, said plurality of valves, and said at least one conduit further comprises a means to substitute said liquid for said gas within said system while maintaining a constant volume within said system.

27. The device of claim 20, wherein said means for removing gas from said system formed by said variable volume chamber, said plurality of valves, and said at least one conduit further comprises a means to controllably create a vacuum within said system,

whereby said liquid aspirated into said system will completely fill the free volume of said system.

28. The device of claim 20, wherein said variable volume chamber further comprises:

- a. a cavity of uniform cross section with respect to the longitudinal axis of said cavity,
- b. an opening at one end of said longitudinal axis of said cavity,

- c. an orifice of cross sectional area equal to or less than the cross sectional area of said cavity located at the end opposite to said opening, and
- d. a member slidably engaged in said cavity having a geometry substantially conforming to the geometry of said cavity,
whereby said member may be retracted from said orifice of said cavity to aspirate said liquid into said cavity, and said member may be advanced toward said orifice to expel said liquid from said cavity.

29. A device for the volumetric measurement and dispensing of liquids comprising

- a. a variable volume chamber,
- b. a means for controllably adjusting the volume of said variable volume chamber,
- c. at least one valve,
- d. at least one conduit disposed between said variable volume chamber and said at least one valve for the purpose of aspirating liquid into or dispensing said liquid from said variable volume chamber, and
- e. a means for removing gas from a system formed by said variable volume chamber, said at least one valve, and said at least one conduit, said means for removing gas comprising a fluid path extending from the interior to the exterior of said variable volume chamber, said fluid path being distinct from said at least one conduit, and said fluid path in fluid communication with at least one additional valve,

whereby said liquid aspirated into said system substantially fills said system thereby minimizing the difference between the volume of said aspirated liquid and the volume of said system.

30. The device of claim 29, wherein said device further comprises a controller,

whereby said controller is in communication with said means for controllably adjusting the volume of said variable volume chamber, a means for actuating said at least one valve, and a means for actuating said at least one additional valve.

31. The device of claim 29, wherein said at least one additional valve in fluid communication with said fluid path is in fluid communication with a body of gas disposed external to the volume defined by the interior of said system whereby said gas may be either controllably expelled into said body of gas from said system or a volume of gas may be aspirated into said system from said body of gas.
32. The device of claim 31, wherein said at least one valve is in fluid communication with a body of liquid, whereby said liquid may be controllably aspirated into said variable volume chamber from said body of liquid or expelled from said variable volume chamber into said body of liquid.
33. The device of claim 29, wherein said means for removing gas from said system formed by said variable volume chamber, said at least one valve, and said at least one conduit further comprises a means to minimize the free volume of said system prior to aspiration of a liquid.
34. The device of claim 29, wherein said means for removing gas from said system formed by said variable volume chamber, said at least one valve, and said at least one conduit further comprises a means to substitute said liquid for said gas within said system by controllably adjusting the volume of said variable volume chamber in conjunction with the actuation of said at least one additional valve in fluid communication with said fluid path.
35. The device of claim 29, wherein said means for removing said gas from said system formed by said variable volume chamber, said at least one valve, and said at least one conduit further comprises a means to substitute said liquid for said gas within said system while maintaining a constant volume within said system.
36. The device of claim 29, wherein said means for removing gas from said system formed by said variable volume chamber, said at least one valve, and said at least one conduit further comprises a means to controllably create a vacuum within said system,

whereby said liquid aspirated into said system will completely fill the free volume of said system.

37. The device of claim 29, wherein said variable volume chamber further comprises:

- a. a cavity of uniform cross section with respect to the longitudinal axis of said cavity,
- b. an opening at one end of said longitudinal axis of said cavity,
- c. an orifice of cross sectional area equal to or less than the cross sectional area of said cavity located at the end opposite to said opening, and
- d. a member slidably engaged in said cavity having a geometry substantially conforming to the geometry of said cavity,

whereby said member may be retracted from said orifice of said cavity to aspirate said liquid into said cavity, and said member may be advanced toward said orifice to expel said liquid from said cavity.

38. A method to accurately aspirate any given volume of liquid comprising the steps of

- a. providing a variable volume chamber in fluid communication with at least one valve, providing at least one conduit disposed between said variable volume chamber and said at least one valve, providing a fluid path distinct from said at least one conduit, said fluid path extending from the interior to the exterior of said variable volume chamber and said fluid path being in fluid communication with at least one additional valve, and providing at least one means of detecting the presence or absence of said liquid in said fluid path,
- b. opening said at least one valve,
- c. closing said at least one additional valve,
- d. placing said at least one valve in fluid communication with said liquid to be aspirated,

- e. aspirating an initial volume of said liquid less than said given volume of said liquid into a system formed by said variable volume chamber, said at least one conduit, and said fluid path, by controllably increasing the volume of said variable volume chamber,
- f. closing said at least one valve,
- g. opening said at least one additional valve,
- h. exhausting gas from said system through said fluid path by controllably decreasing the volume of said variable volume chamber until said liquid is displaced to a precise location in said fluid path predetermined by the position of said at least one means of detecting the presence or absence of said liquid,
- i. closing said at least one additional valve,
- j. opening said at least one valve,
- k. aspirating an additional volume of said liquid equal to the difference in volume between said given volume of said liquid and said initial volume of said liquid,

whereby the known volume of said system in conjunction with the complete filling of said system results in an accurate measurement of the volume of the aspirated liquid and aspiration of an excess volume of said liquid in addition to said given volume of liquid is not necessary to achieve an accurate measurement of said given volume of liquid.